

**IN THE CLAIMS**

**Please amend the claims as indicated:**

**Claims 1-72 canceled.**

7 parameter of the pulsed RF field.

8

1 75. (new) The apparatus of claim 74 whercin the processor is at a downhole location.

2

1 76. (new) The apparatus of claim 74 wherein the pulsed RF field comprises a pulse  
2 sequence of the form:

3

$$\left[ TW_i - 90_{\pm\pi/2} - (\tau - X - \tau - echo)_j \right]_i$$

5

6 wherein  $TW$  is a wait time,  $90_{\pm\pi/2}$  refers to a phase alternated  $90^0$  tipping pulse,  $X$   
7 is a refocusing pulse with a tipping angle that lies between  $90^0$  and  $180^0$ ,  $j$  is the  
8 number of echos observed,  $i$  is a number of repetitions, and  $2\tau$  is an interecho  
9 spacing, and wherein the parameter of interest of the pulsed RF field is selected  
10 from the group consisting of: (i) the tipping angle of the refocusing pulse, (ii) the  
11 number of echos  $j$ , (iii) the number of repetitions  $i$ , (iv) the interecho spacing, and  
12 (v) the wait time.

13

1 77. (new) The apparatus of claim 74 further comprising a telemetry module for  
2 communicating signals to and from a surface location

3

1 78. (new) The apparatus of claim 76 wherein the processor applies a stimulated echo  
2 correction to the first measurements, the stimulated echo correction determined by

3 at least one of (i) a temperature of the formation, (ii) an intensity of the RF field,  
4 (iii) a bandwidth of the tipping pulse, and, (iv) a bandwidth of the refocusing  
5 pulse.

6

1 79. (new) The apparatus of claim 74 further comprising a formation evaluation sensor  
2 for making second measurements indicative of at least one of (i) a lithology of the  
3 formation, and, (ii) a fluid content of the formation.

4

1 80. (new) The apparatus of claim 79 wherein the expert system determines from the  
2 second measurements at least one of (i) the lithology of the formation, (ii) the  
3 fluid content of the formation, and (iii) petrophysical properties.

4

1 81. (new) The apparatus of claim 74 further comprising a formation pressure tester  
2 (FPT) wherein the processor determines a fluid viscosity from measurements  
3 made by the FPT and NMR sensor.

4

1 82. (new) The apparatus of claim 74 wherein the parameter of interest comprises at  
2 least one of (i) clay bound water, (ii) gas saturation, (iii) porosity, (iv) bound  
3 volume irreducible, (v) bound water movable, (vi) shale content, and (vii)  
4 presence of hydrocarbons.

5

1 83. (new) The apparatus of claim 74 further comprising an additional sensor selected

2 from the group consisting of (i) a gamma ray sensor, (ii) a neutron sensor, (iii) a  
3 resistivity sensor, and, (iv) an acoustic sensor.

4

1 84. (new) The apparatus of claim 74 wherein the processor provides a quality control  
2 (QC) diagnostic based on at least one of (i) a signal from a motion sensor, (iii)  
3 a sum of echos (SE) produced by the NMR sensor.

4

1 85. (new) The apparatus of claim 74 wherein the first measurements further comprise  
2 two channels of data, the processor further determining a corrected measurement  
3 based on said two channels.

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1 86. (new) The apparatus of claim 74 wherein the processor applies a calibration to  
2 the first measurements, said calibration based upon measurements made with the  
3 NMR sensor in a medium of known porosity.

4

1 87. (new) The apparatus of claim 74 wherein the expert system comprises a neural  
2 net that has been trained and validated.

3

1 88. (new) A method of determining a parameter of interest of an earth formation  
2 comprising:

3 (a) conveying a logging assembly into a borehole in the earth formation;  
4 (b) using a nuclear magnetic resonance (NMR) sensor on the logging

5 assembly and producing a pulsed RF field for obtaining first  
6 measurements indicative of the parameter of interest of the formation, the  
7 RF field characterized by a plurality of parameters; and  
8 (c) using a processor including an expert system for determining a lithology of  
9 the formation and selecting at least one parameter of the pulsed RF field  
10 based at least in part on the determined lithology.

11

1 89. (new) The method of claim 88 wherein the processor is at a downhole location.

2

1 90. (new) The method of claim 88 the pulsed RF field a pulse sequence of the form:

2

$$\left[ TW_i - 90_{\pm\pi/2} - (\tau - X - \tau - echo)_j \right]_i$$

4

5 wherein  $TW$  is a wait time,  $90_{\pm\pi/2}$  refers to a phase alternated  $90^0$  tipping pulse,  $X$   
6 is a refocusing pulse with a tipping angle that lies between  $90^0$  and  $180^0$ ,  $j$  is the  
7 number of echos observed,  $i$  is a number of repetitions, and  $2\tau$  is an interecho  
8 spacing, and wherein the parameter of interest of the pulsed RF field is selected  
9 from the group consisting of: (i) the tipping angle of the refocusing pulse, (ii) the  
10 number of echos  $j$ , (iii) the number of repetitions  $i$ , (iv) the interecho spacing, and  
11 (v) the wait time.

12

1 91. (new) The method of claim 88 further comprising using a telemetry module on the

2           BHA for communicating signals to and from a surface location.

3

1       92. (new) The method of claim 90 further comprising using the processor for applying a  
2           stimulated echo correction to the first measurements, the stimulated echo  
3           correction determined by at least one of (i) a temperature of the formation; (ii) an  
4           intensity of the RF field, (iii) a bandwidth of the tipping pulse, and, (iv) a  
5           bandwidth of the refocusing pulse.

6

1       93. (new) The method of claim 88 further comprising using a formation evaluation sensor  
2           for making second measurements indicative of at least one of (i) a lithology of the  
3           formation, and, (ii) a fluid content of the formation.

4

1       94. (new) The method of claim 93 further comprising using the expert system for  
2           determining from the second measurements at least one of (i) the lithology of the  
3           formation, (ii) the fluid content of the formation, and (iii) petrophysical properties  
4           of the formation

5

1       95. (new) The method of claim 88 further comprising:

2           (i)      using a formation pressure tester (FPT) for providing a measurement  
3                   indicative of a mobility of a fluid in said formation, and  
4           (ii)     using said downhole processor for determining a fluid viscosity from  
5                   measurements made by the FPT and NMR sensor.

6

1 96. (new) The method of claim 88 wherein the parameter of interest comprises at least  
2 one of (i) clay bound water, (ii) gas saturation, (iii) porosity, (iv) bound volume  
3 irreducible, (v) bound water movable, (vi) shale content, and (vii) presence of  
4 hydrocarbons.

5

1 97. (new) The method of claim 88 further comprising using an additional sensor  
2 selected from the group consisting of (i) a gamma ray sensor, (ii) a neutron  
3 sensor, (iii) a resistivity sensor, and, (iv) an acoustic sensor, for making a  
4 measurement indicative of a parameter of interest of said formation.

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1 98. (new) The method of claim 88 further comprising using the processor for  
2 providing a quality control (QC) diagnostic based on at least one of (i) a signal  
3 from a motion sensor, (iii) a sum of echos (SE) produced by the NMR sensor  
4 assembly.

5

1 99. (new) The method of claim 98 further comprising using the processor based on  
2 said QC diagnostic for at least one of (i) discarding a subset of the first  
3 measurements, (ii) replacing a subset of the first measurements with another  
4 subset of the first measurements, (iii) zeroing out partial echo trains.

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